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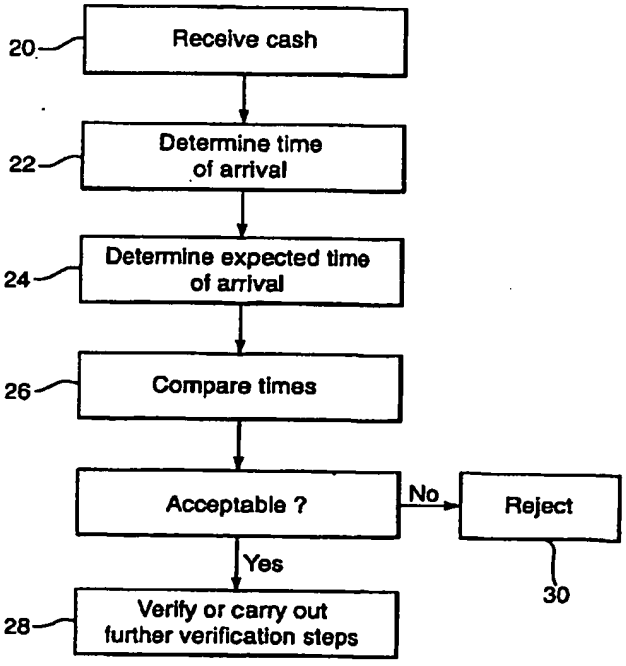
[Continued on next page]

(54) Title: VERIFICATION METHOD AND APPARATUS



(57) Abstract: A method of verifying the integrity of an item of value received at a destination location following transfer from a source at location is described. The method comprises carrying out one or more verification steps, at least one of which (26) comprises determining whether the time of arrival (22) of the item of value at the destination location satisfies a predetermined condition.

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VERIFICATION METHOD AND APPARATUS

The present invention relates to methods and apparatus to enable secure, auditable, efficient and cost effective movement of items of value.

The present invention will be described in the context of a retail application. It should be noted, however, that the invention could be applied in non-retail applications. Indeed the invention could be applied in any environment where items of value are transported and therefore exposed to risk of theft or tampering. Items of value in this context include bank notes, cheques, vouchers, stamps, fiscal stamps, coins, casino chips, lottery tickets, scratch cards and the like. The invention in its widest sense could also be envisaged to relate to other valuable items that are transported under secure conditions such as gemstones, precious metals and the like.

Items of value such as cash (coins and banknotes) are typically transported in a secure manner in tamper evident and secure containers. However it is known for individuals to open such containers without compromising the physical security measures. The recipient will then receive and accept the items not knowing that the container has been compromised.

In accordance with a first aspect of the present invention, a method of verifying the integrity of an item of value received at a destination location following transfer from a source location comprises carrying out one or more verification steps, at least one of which comprises determining whether the time of arrival of the item of value at the destination location satisfies a predetermined condition.

The invention introduces an event timing process as a means to provide a measure of the risk that an item of value is no longer genuine, for example a container or package has been tampered with.

There are a variety of ways in which the predetermined condition can be defined. For example, the verification process may be programmed to expect to receive the item of value at a certain absolute time or within a certain absolute time period. Thus for example it may be expecting a particular item of value between 6pm and 7pm on a particular day. This time may be set independently or, more commonly, will be communicated to the destination location, for example on or in a container holding the item of value.

Alternatively, the predetermined condition is determined in response to the time at which the item of value leaves the source location. Thus, once that time is known, the time of arrival of the destination location can be predicted and that part of the verification process will be satisfied if the item of value arrives within a predetermined tolerance of the expected time.

Details of the predetermined condition could be stored in a memory, for example having been communicated from the source location, the memory being sited at the destination location or in a separate host accessible both by the verification process and from the source location. In addition, or alternatively, details enabling the predetermined condition to be determined can be provided in association with the item of value. For example, the details could be provided on or in a package containing the item of value. This could be done by way of a code such as a bar code, it being preferred that the information is given in a covert manner. Alternatively, the information could be contained within a memory chip such as an RFID on or in the package.

The data enabling the predetermined condition to be determined could constitute the expected arrival time of the destination location, the time at which the item of value left the source location, and the like.

The item of value may be verified directly but typically will be secured within a package, the method

comprising determining whether the time of arrival of the package at the destination location satisfies a predetermined condition.

It should be appreciated that typically the invention will be used as one part of an overall verification process with other verification steps also being carried out as known in the art. These might include, in the case of packaged items of value, verifying other security features such as security threads, security printing, watermarks and the like provided on or in the package.

The source and destination locations can be defined by any pair of locations between which items of value are transferred. Examples include retail tills, a retailer back office, a cash-in-transit location, and financial institution such as a bank.

Some examples of cash transfer processes known in the art together with examples of the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 illustrates an example of a known cash management cycle within a typical large retailer;

Figures 2A and 2B illustrates the current cash cycle time line using either the traditional banking cycle or the Prime Count cycle, respectively;

Figure 3 illustrates schematically the requirements to achieve a secure auditable physical cash flow;

Figure 4 is a flow diagram illustrating an example of the method; and,

Figure 5 is a schematic block diagram of cash handling apparatus at a destination location.

Before considering the invention in detail it is worthwhile reviewing one example of a cash management cycle. Illustrated in Figure 1 is an example of a cash management cycle within the retail environment.

In Figure 1 cash is accepted from a customer at a till 1A-1C. In the majority of retailers there will be more than one till and indeed could be tens of tills. Dependent

upon the retailer, the cash may be taken directly to a back office 2 to be reconciled or taken via a supervisor 3. The supervisor 3 collects the cash and may also issue change, and start funds as and when required. Irrespective of the route, the cash is taken to a secure back office area 2 for counting and reconciling internally.

Once counted and reconciled the cash is taken once a week or more frequently to a Cash in Transit (CIT) operator 4. The transportation of cash is usually via a secure CIT logistics operator 5. Once the cash is in the CIT it usually has to be prepared 6 and put into a format suitable for high speed sorting and counting. This process is very time consuming and expensive. Once prepared the cash is counted and reconciled 7. Dependent upon the CIT operator's relationship with a commercial bank 8 the cash may or may not be then taken to the commercial bank via an operator 9. Increasingly the cash is held at the CIT 4 and redistributed back to retailers. The bank 8 receives details of the cash amount from the CIT 4 and credits the retailer's account accordingly. This cycle from retailer accepting cash to having their account credited may take a significant period of time. The period of time is governed by the cash cycle within which the retailer is operating. There are two main cash cycles utilised by retailers, a Traditional Banking cycle and the Prime Count cycle which are illustrated in Figures 2A and 2B respectively.

In both cash cycles the trading week is shown as running from Sunday to Saturday, which is typical but not always the case. Considering first the Prime Count cycle (Figure 2B), the cash is collected by a CIT logistics operator 4 on a Monday. It is then delivered and through Tuesday prepared in a suitable format for counting. On Wednesday the cash is then counted and finally the retailer's account is credited on the Thursday. If there is a very high volume of cash, the preparation and counting may take several days each and thus delay the crediting of the account. For some retailers who take very large

volumes of cash it can be more economically viable to have multiple collections during the retail week.

Within the traditional banking cycle (Figure 2A) again the retail week is shown running from Sunday to Saturday. On Monday the retailer will collect the cash which is then counted and reconciled internally on the Tuesday. Late Tuesday the cash is collected and taken to the CIT operator. The CIT operator prepares and counts the cash on Wednesday and into Thursday as appropriate for the volume of cash. Finally the retailer has their account credited on the Thursday or Friday. Again the time required by the CIT is very much dependent upon the volume of cash and the amount of preparation required. The retailer would like to improve this situation in two ways. Firstly the retailer would like to limit the cost of the CIT logistics, preparation and counting operations and secondly the retailer would like their account to be credited far sooner.

The cycle shown in Figure 1 has two significant issues associated with it. Firstly there is a need to increase the speed at which cash ownership can be transferred while maintaining security of the cash itself. The delay in transferring the ownership of cash is directly related to the second issue. That is the cycle has numerous points at which the risk of fraudulent activity is increased. Fraudulent activity is most likely to occur where there is some form of human interaction with the cash or alternatively where the cash is being transported from one secure holding point to another. The consequence of these 'high' risk points within the cycle is that the recipient of the cash feels it is necessary to recount and reconcile the received cash against the value supposedly passed.

Considering these problems in more detail, the cycle illustrated in Figure 1 can be further simplified by considering the basic components independently of the retailer, CIT or commercial bank. This is illustrated in Figure 3. In order to achieve a fully integrated retail

cash management solution three key elements need to be considered. The provision of a secure auditable physical cash flow 10, the provision of a secure auditable digital cash flow 11 and finally the apparatus and infrastructure 12 required to implement both of the above. The three elements are intended to provide the data integrity and security to remove the need for multiple cash counts and consequently speed up the cash cycle allowing the retailer to be credited far sooner than is currently possible. The combination of these three components enables a secure cash management cycle. In one aspect, this invention helps enable the secure cash management cycle and may be implemented on its own or in combination with one or a number of other measures.

The inventors have recognised that while risk can be minimised from the cash cycle it cannot be wholly removed. Therefore rather than try to eradicate the risk entirely it is proposed to provide some means to measure the risk and use this measure to set a degree of confidence in the security of both the physical cash and the data associated with it. Within the retail cycle this data is likely to be the Electronic Point of Sale (EPOS) data or a subset of such along with other pertinent information.

It is already well known to transport the cash in secure tamper evident containers. Dependent on the value of cash been transported such containers range from flexible envelopes with visual tamper evident devices to secure cartridges fitted with sophisticated security and degradation systems. Such containers do significantly reduce the risk of fraudulent activity when transporting cash in relatively insecure environments and have proved beneficial. Further enhancements to such devices are described in the applicants co-pending International application of even date entitled "Tamper Evident Container" (Agent's Ref: RSJ07664WO) and WO-A-02/45042. In the former of these two applications a secure tamper evident container or envelope is also provided with data

relating the contents within. This data may be any or all of:

- ID for the user operating the filling machine
- Filling machine ID
- ID of transaction
- Amount in envelope
- Contents of envelope, denomination, currency type, total value, value denomination
- Destination of deposit, bank account number and type
- Specific instructions on how the deposit should be handled
- Method on how the envelope will be deposited
- How the deposit will take place.
- Time of fill

WO-A-02/45042 relates specifically to a secure tamper evident closure device. It is proposed that by utilizing a tamper evident container, which is also coded in such a way that its content can be identified without opening the container, the risk of fraudulent activity can be further reduced.

Though the examples above do reduce the risk of fraudulent activity they cannot be guaranteed to prevent it. Any tamper evident container can be tampered with by someone with sufficient skill and critically sufficient time. The present invention makes use of the fact that tampering does indeed take time and this can therefore be used as a measure of the risk associated with a container. That is if it is known that a container was packed and shipped at a given time there will be an acceptable period of time before it is due to arrive at the recipient. If the transfer takes longer than that predefined period the risk that the container has been interfered with significantly increases.

A general example of a method according to the invention will now be described and this will then be further exemplified by some more specific examples. In

this example, the steps are set out in Figure 4 and an example of apparatus provided at the destination location or point of reception of the cash is shown in Figure 5. Initially, a package containing cash is received (step 20) at a reception location such as a back office, cash-in-transit handling location, or bank. The package will be provided with an indication such as a bar code on its external surface (although alternatively or additionally the indication could be located within a memory such as an RFID within the package) and this is read by a bar code reader 40. In this example, the time at which the bar code reader 40 is activated is considered to be the time of arrival of the package at the destination location (step 22). Of course, the time of arrival could be set in another way such as the physical time at which the package arrives at the location with the code being read later. The bar code could define an identifier which a microprocessor 42 connected to the reader can use to access information from the store which indicates the content of the package and/or its expected time of arrival at the reception location. The store is indicated at 44 in Figure 5 and may be local to the microprocessor 42 or remote, for example being connected to the microprocessor 42 via the Internet or the like. The memory 44 will have been updated with the relevant information at the time the package was filled with cash.

In other versions, the bar code itself may contain data defining the expected arrival time which can then be used by the microprocessor 42 directly.

In any event, the microprocessor 42 determines the time or time window at which the package is expected to arrive at the reception location (step 24).

The microprocessor 42 then compares the actual time of arrival with the expected arrival time or time window (step 26) and if the actual arrival time falls within an accepted tolerance of the expected arrival time or within the time window then the package is considered to have passed this

test and can either be accepted as verified or alternatively passed on for further verification steps (step 28). If the package is found to be unacceptable then it will be immediately rejected (step 30). Rejection and/or acceptance can be indicated by the microprocessor providing a suitable signal to an output device 46 such as a display, alarm sound or the like.

Some examples of specific applications of the method will now be described.

Movement of Cash within a Large Retailer

We first consider some of the transfer events that take place within a retailer such as a large supermarket. Cash is accepted at a till 1A-1C, typically by a teller but potentially the till may be self service with automated cash acceptance and dispensing facilities. As the cash is accepted at the till EPOS data is generated detailing, amongst other things, the value of the transaction. Periodically the cash is removed from the till and taken to a back office 2 for reconciliation. This may occur once a day at the close of business or more often as required. Typically the reconciliation process compares the EPOS data with the actual till contents and then stores the cash in a secure manner. Unfortunately by the time the cash reaches the back office 2 it has already been exposed to risk of fraudulent activity. The current invention can be utilised to provide confidence in the integrity and security of the physical cash and data associated with it despite it being transported through a non-secure environment.

When moving cash from a source location to a destination location (the till to the back office in this instance) it is usual to do this as quickly as possible to limit the exposure to potentially fraudulent or illegal activity. Furthermore it can be estimated approximately how long that time should be. For example in a large supermarket it may take 30 minutes or more from collection of the cash from a till until it reaches the back office

and is counted into a secure environment. In a smaller retailer with fewer tills and less floor space it may only take 5 minutes or less. In either scenario an approximate transit time is known. If, for whatever reason, the cash takes in excess of the usual period of time to make the journey there is a greater risk that it has been tampered with or mishandled in some way.

The event timing process of the invention can be used as means to measure this risk and assess whether there may be a problem. For example, cash handling apparatus 40-46 in the back office 2 can be set up to "know" that a till 1A-1C is due to be cashed up at a certain time. It also knows how long it should take the till to cash and how long the contents will take to be moved from the till to the back office. Further to this, the cash handling apparatus can know, approximately or accurately, what the value of those till contents should be based on previous till totals or as a result of the information being loaded into the memory 44 from the till or being encoded on or in a package containing the cash. If for some reason the value of the till contents falls short by a significant margin and the till took in excess of the estimated time to travel from the till to the back office 2 the cash handling apparatus could be instructed to alert the user and a supervisor via the output device 46. The supervisor can then review the situation and make a decision as to whether the till contents were indeed correct or further action needs to be taken. A suitable tolerance can be built into both the timing aspect and the value aspect to prevent the cash handling apparatus from alerting too frequently. The rules governing the process could be very simple, as above, or more complex. For example the longer the delay between till and back office the lower the discrepancy needs to be between estimated value and actual value received.

The information relating to the value of contents received may be communicated in a number of ways. In a preferred embodiment the tills 1A-1C are networked to the

cash handling apparatus 40-46. The actual EPOS data from the till could be used to tell the cash handling apparatus exactly how much cash to expect. The till would also notify the cash handling apparatus that it is being cashed up and to expect the contents in a certain period of time. Even when such accurate data as to expected funds is available it is still preferable that some tolerance will be built in to allow some variation from the expected amount. This will allow for the wrong change being given and occasional or other minor, accidental errors that will always occur.

Where cash is transported from the till with data associated with it, the cash may be held in a secure container or envelope to which is associated a suitable data storage device providing detail on the value, denomination and potentially other EPOS data. Such a situation is described in more detail in the previously mentioned co-pending applications. It may be a printed bar code, data in a memory such as a RFID etc.

In this case, the retailer back office 2 receives cash (step 20, Figure 4) and determines its time of arrival (step 22).

Here as the value and denomination is stored securely it is theoretically possible to avoid the need to recount the cash. However the user has to trust that both the physical cash and data associated with it have retained their integrity. Obviously, as before, the longer the secure container is not in a secure environment, such as being carried across a shop floor, the longer it is exposed to risk. If the container is transported from the till to the back office within the allotted time the cash handling apparatus will trust the data and will not request the cash be counted again. The container can then be stored securely in a safe area. Upon acceptance of the valid data the cash handling apparatus will update a data file to indicate that the cash has been accounted for and stored securely. If however the cash is not presented within the

prescribed time limit the cash handling apparatus will request the cash be counted again. If the value is correct the data file will be updated and the cash taken for secure storage. If the value is wrong a supervisor will be alerted and further action taken as required.

A further benefit is that by using either the timing device or a network process the cash handling device is also in a much better position to pre-empt and predict forthcoming activity and take steps to ensure no delay is caused to the users. By minimising delays and having some knowledge of what to expect the process minimises the risk.

So far we have suggested using the timing process in isolation to determine whether to trust the data associated with it. In reality it is likely to be only one of a number of factors considered when deciding whether or not to trust the integrity of the container. Consideration may also be given to other factors such as the physical integrity of the container, the environment through which the container is being transported. Further detail and an example of a method and apparatus for inspecting the physical integrity of a container is given in our International application of even date entitled "Tamper Evident Container" (Agent's Ref: RSJ07664WO).

The example above focuses on the relatively closed system wholly within a retailer. It should be appreciated that the invention could find wider application within the retail cash cycle. Indeed the invention could find application at any point in the cash cycle where physical cash is moved between two points e.g. from the retailer 2 to the CIT 4 or from the CIT 4 to the commercial bank 8.

Movement of non-cash items

As indicated previously the invention could also be equally well applied in non-retail applications. For example one serious issue faced by lottery scratch cards is tampering. Lottery scratch cards are used in prize games and may have a potential value of thousands of pounds. Despite that, they are relatively insecure documents due to

the pressure to minimise costs of production. There is a trend to increase the security of such documents but they still remain a relatively simple document to tamper with. It is known for unscrupulous individuals to inspect scratch cards by various means to locate cards having winning values associated with them. They then remove these cards leaving only those cards with no or very low winning values. Such inspection may be relatively crude, for example removing the scratch off ink and then reprinting it onto cards with no value. Alternatively, more advanced non-destructive techniques may be used. Common to whatever approach that is used is that the process of inspection takes time.

Typically, scratch cards are manufactured and stored in a controlled environment and when they arrive in a store they are also stored in a secure manner. However, as in the retail cash cycle example, there is a period where they have to be transported between the two secure points and therefore exposed to a risk. To overcome this, during transportation the scratch cards are placed in a tamper evident container. In addition, the tamper evident container is provided with details of its contents, the time it was filled and the time it is due to arrive at the retailer. Such information should be provided in a form that can be read by the receiving party. In this instance as the receiving party is likely to be a retailer or store one possible format is a bar code. The majority of stores nowadays have bar code reading equipment and would be able to read the bar code. When the store receives the container, prior to accepting the scratch cards they will read the bar code to view the information regarding contents, time of dispatch and expected time of arrival. If all is correct the store accepts the scratch cards. If some thing is incorrect the store may refuse the scratch cards or may have a phone number to ring in order to make an enquiry as to the discrepancy.

CLAIMS

1. A method of verifying the integrity of an item of value received at a destination location following transfer from a source location, the method comprising carrying out one or more verification steps, at least one of which comprises determining whether the time of arrival of the item of value at the destination location satisfies a predetermined condition.

2. A method according to claim 1, wherein the predetermined condition is defined by an absolute time period within which the item of value is expected.

3. A method according to claim 1, wherein the predetermined condition comprises the expected length of time between the item of value leaving the source location and arriving at the destination location.

4. A method according to any of the preceding claims, wherein details of the predetermined condition are stored in a memory at the destination location.

5. A method according to any of claims 1 to 3, wherein details of the predetermined condition are provided in association with the item of value.

6. A method according to any of the preceding claims, wherein the item of value is secured within a package, the method comprising determining whether the time of arrival of the package at the destination location satisfies a predetermined condition.

7. A method according to claim 6, wherein the details of the predetermined condition are provided on or in the package.

8. A method according to claim 6 or claim 7, wherein the package is tamper evident.

9. A method according to any of the preceding claims, wherein details relating to the predetermined condition are communicated from the source location to the destination location.

10. A method according to claim 9, wherein the details comprise one or more of the time of departure from the source location, the expected time of arrival at the destination location, and the length of time between leaving the source location and arriving at the destination location.

11. A method according to any of the preceding claims, wherein the item of value comprises cash, for example coins and/or banknotes.

12. A method according to any of the preceding claims, wherein the source location comprises one of a retail till, retailer back office, cash-in-transit centre, and financial institution such as a bank.

13. A method according to any of the preceding claims, wherein the destination location comprises one of a retail till, retailer back office, cash-in-transit centre, and financial institution such as a bank.

14. Apparatus for verifying the integrity of an item of value received at a destination location following transfer from a source location, the apparatus comprising a verification system for carrying out one or more verification steps, at least one of which comprises determining whether the time of arrival of the item of value at the destination location satisfies a predetermined condition.

15. Apparatus according to claim 14 for carrying out a method according to any of claims 1 to 13.

16. An item of value transfer system comprising apparatus according to claim 14 or claim 15 located at a destination location; and a source location from which items of value are transferred to the destination location.

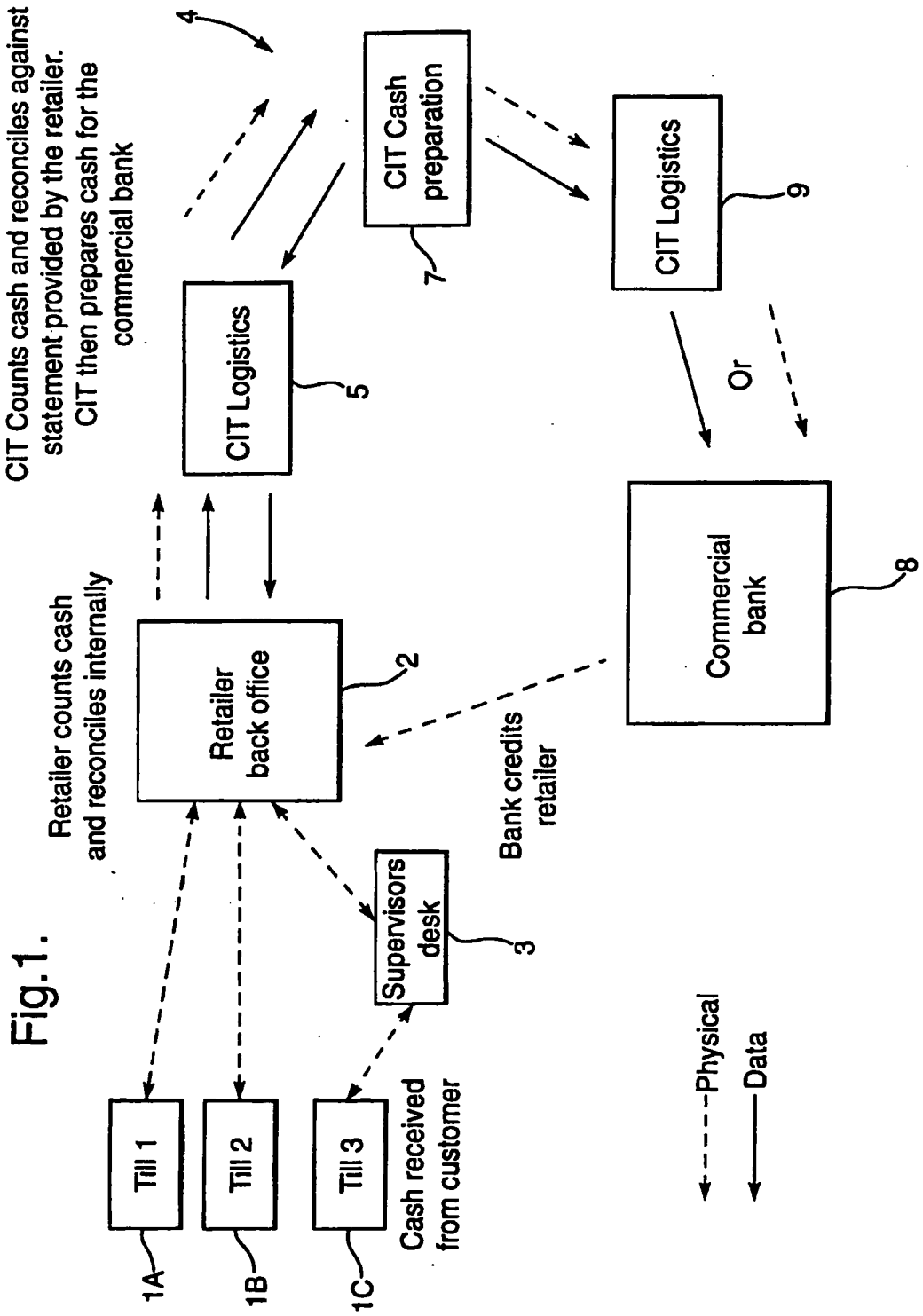

CIT Counts cash and reconciles against statement provided by the retailer.
CIT then prepares cash for the commercial bank
4
CIT Cash preparation
7
CIT Logistics
9
CIT Logistics
5
Or
Retailer counts cash and reconciles internally
Retailer back office
2
Commercial bank
8
Bank credits retailer
Supervisors desk
3
Till 1
Till 2
Till 3
1A
1B
1C
Cash received from customer
Physical
Data

Fig.1.

Fig.2A.

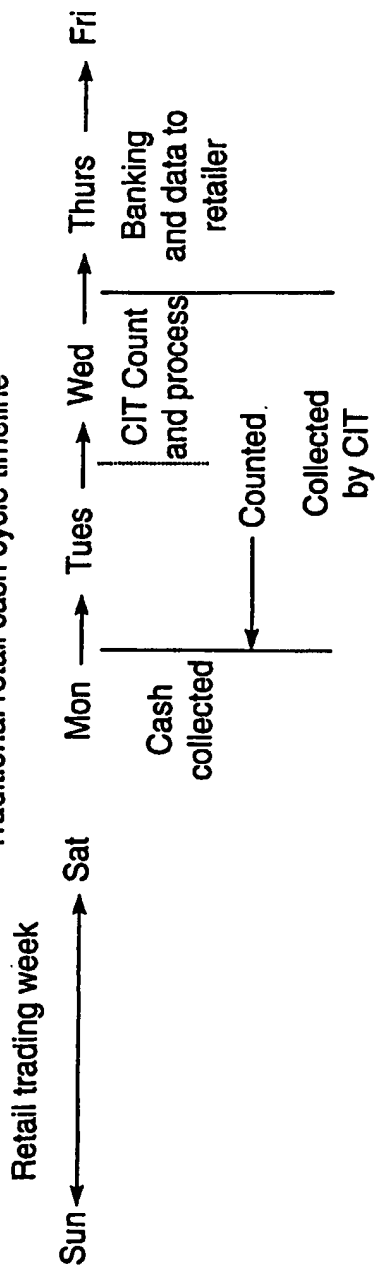
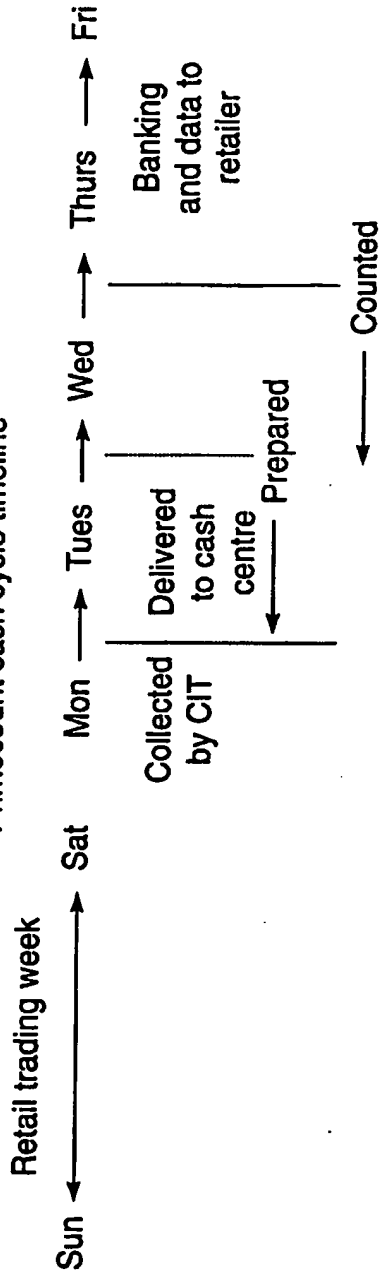

Traditional retail cash cycle timeline
Retail trading week
Sun
Sat
Mon
Tues
Wed
Thurs
Fri
Cash collected
Collected by CIT
Counted
CIT Count and process
Banking and data to retailer

Fig.2B.


Primecount cash cycle timeline
Retail trading week
Sun
Sat
Mon
Tues
Wed
Thurs
Fri
Collected by CIT
Delivered to cash centre
Prepared
Counted
Banking and data to retailer

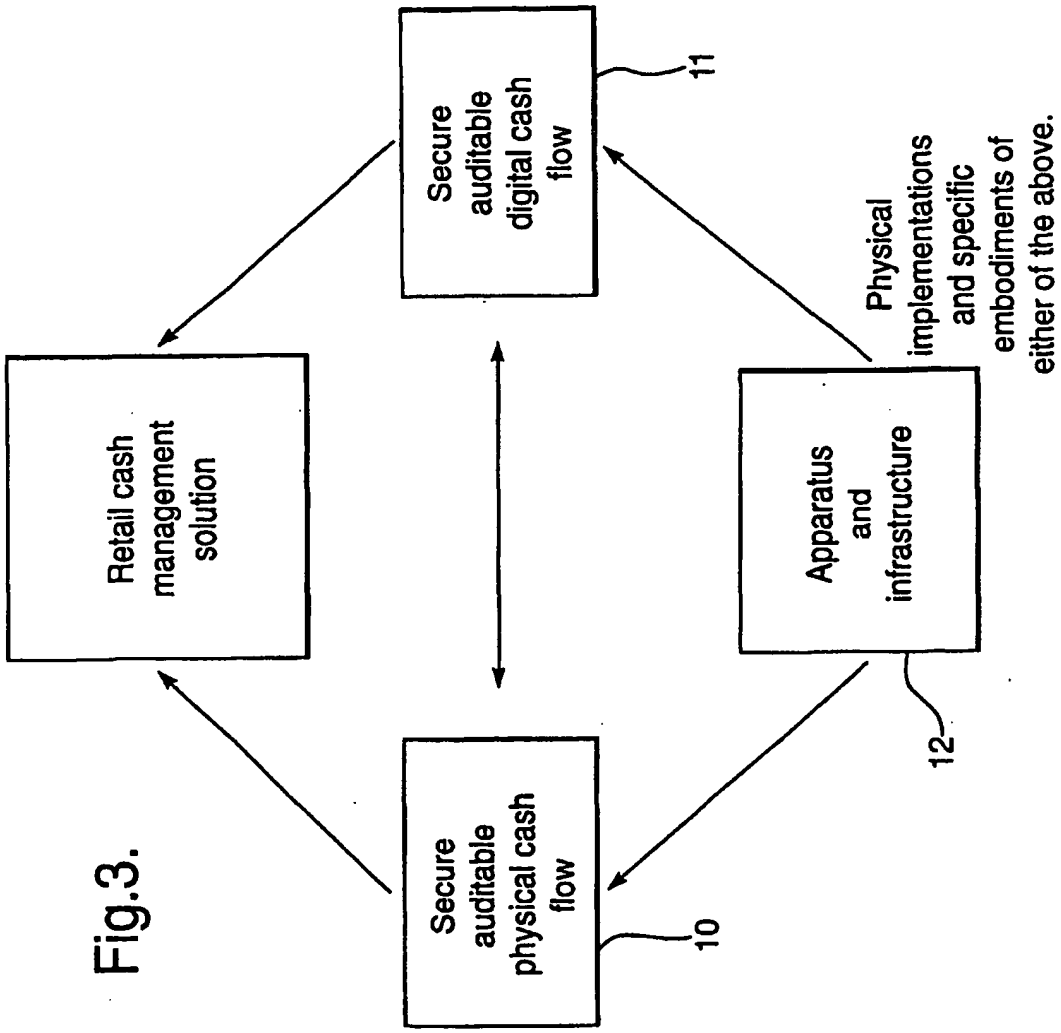

Secure auditable digital cash flow
11
Retail cash management solution
Apparatus and infrastructure
Physical implementations and specific embodiments of either of the above.
12
Secure auditable physical cash flow
10

Fig.3.

Fig.4.

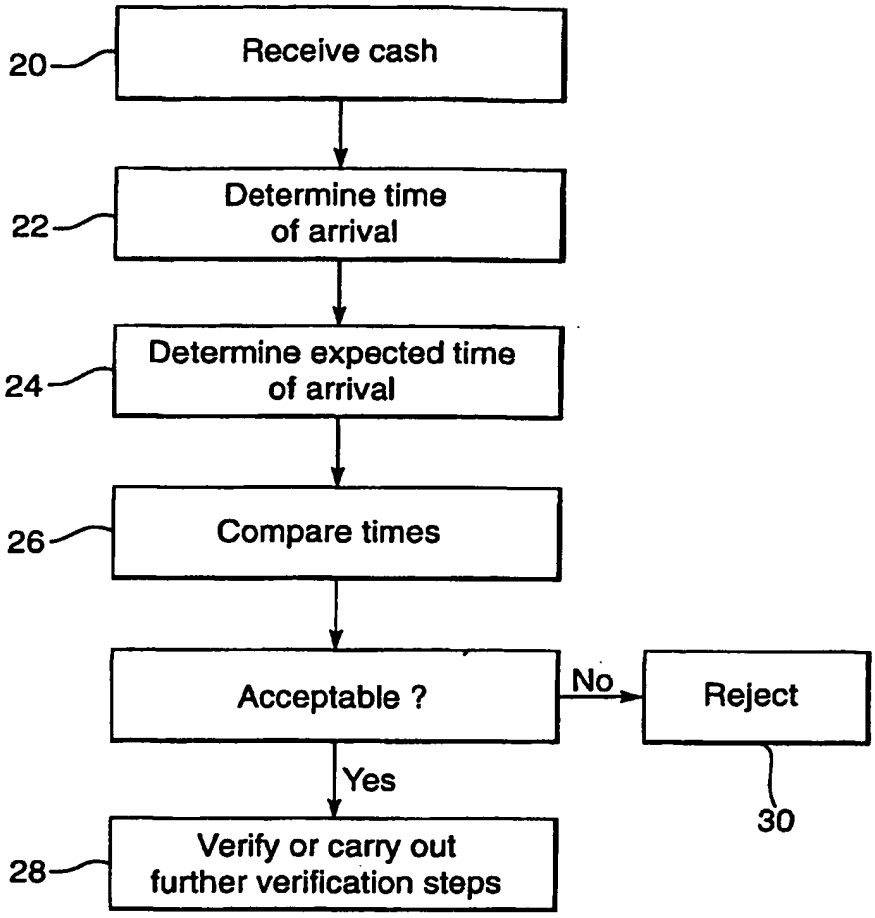
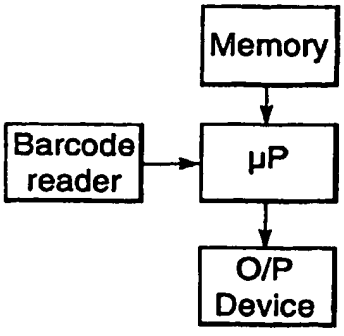

20
Receive cash
22
Determine time of arrival
24
Determine expected time of arrival
26
Compare times
Acceptable ?
No
Reject
30
Yes
28
Verify or carry out further verification steps

Fig.5.


Memory
Barcode reader
µP
O/P Device

INTERNATIONAL SEARCH REPORT

Internatic pplication No
PCT/GB 02/05250

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G07D11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	GB 2 280 056 A (TRANSALARM LTD) 18 January 1995 (1995-01-18) abstract page 2, line 19 - line 27 page 3, line 19 - line 23 page 4, line 10 - line 12 page 5, line 7 - line 9	1-8, 11-16 9
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☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
13 February 2003	19/02/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Verhoef, P

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INTERNATIONAL SEARCH REPORT

Internatic pplication No
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